PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of

Marc FERRATO, *et al.*

Docket No: Q77425

Appln. No.: 10/661,476

Group Art Unit: 1762

Confirmation No.: 9244

Examiner: Katherine A. BAREFORD

Filed: September 15, 2003

For: A METHOD OF FABRICATING AN ALUMINUM NITRIDE (AlN) SUBSTRATE

**DECLARATION UNDER 37 C.F.R. § 1.132**

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Alain PETITBON, hereby declare and state:

THAT I am a citizen of France;

THAT I have received a Degree of Engineer from Ecole Nationale Supérieure de Chimie de Toulouse (France) and a post-graduate degree in physical chemistry from Toulouse University (France);

THAT I was Manager of the Ceramic group at the research center of Alcatel Alstom through 1998, and that I have been an expert and trainer in Materials and Processes at Alstom Transport since 1999;

THAT I have obtained many patents in the fields of ceramic materials, laser processing, and power electronics, such as, for example, FR 2 845 078, FR 2 811 475, FR 2 810 845, FR 2 809 281, FR 2 785 448, FR 2 785 447, FR 2 767 605, FR 2 765 067, FR 2 755 129,

FR 2 754 669, FR 2 737 608, FR 2 692 887, FR 2 689 315, FR 2 683 086 FR 2 678 783, FR 2 678 419, FR 2 669 241, FR 2 667 802, FR 2 641 775, FR 2 605 310, FR 2 567 148, FR 2 517 696, FR 2 494 586, FR 2 473 313, and FR 2 830 008;

THAT I have worked for several years on AlN substrates for power electronics in terms of metallization, heat conductivity and heat dissipation, soldering and connecting silicon chips, cooling and packaging in view of making integrated power electronic switches, and that I have particularly focused my works on decreasing the overall thermal resistance of the electronic packaging, wherein the main thermal resistance is due to the AlN substrate because of its thickness; and

THAT I am a co-inventor of the present U.S. patent application and familiar with its prosecution, including, for example, the non-final Office Action mailed November 7, 2005, and the rejections set forth by the examiner therein.

For the following reasons, the claimed method is not rendered obvious by any combination of the applied art.

(i) When mixed with water, the AlN grains of Knudsen, even if they are coated with an yttrium oxide precursor, are not suitable for use in a support for electronic components.

Knudsen teaches dispersing the moisture-resistant AlN powder in an aqueous medium at column 4, lines 1 to 4.

However, the thermal conductivity of AlN ceramics is very sensitive to lattice imperfections which lead to a decrease in the free pathlength of phonons. The most important defects in AlN lattices are oxygen impurities.

In order to obtain a substrate which has a thermal conductivity which renders it suitable for use as a support for electronic components, such as, for example, a thermal conductivity of at least 180 W/m.K, the AlN powder should have a low oxygen content, such as, for example, less than 1%, which is not possible when the AlN powder is in contact with moisture or water.

When mixed with water, the AlN grains of Knudsen, even if they are coated with an yttrium oxide precursor, will always undergo a small hydrolysis that results in a powder having an oxygen content, such as, for example, greater than 1%, which renders the powder unsuitable for use in a support for electronic components. Knudsen's moisture-resistant powder mixed in a water slurry cannot lead to a suitable thermal conductivity, even if it could be immerged in water without significant hydrolysis (for Knudsen, significant hydrolysis means violent reaction and pH increase). If the thus obtained powder was atomized and sprayed, the result would be a substrate having a thermal conductivity, such as, for example, less than 180 W/m.K, which is unsuitable for use as a support for electronic components.

(ii) Knudsen's slurry of AlN powder mixed with an yttrium-containing compound, prior to dispersal in an aqueous medium, cannot be atomized.

At column 3, Knudsen teaches a first step of manufacturing an AlN moisture-resistant powder, wherein an AlN powder is mixed with an yttrium-containing compound and a polar

organic solvent to obtain a slurry. At this stage, the AlN grains have not yet been dispersed in an aqueous medium. Thus, at this stage, hydrolysis of the AlN grains has not yet occurred.

However, the above slurry cannot be atomized because it does not contain any agent to stabilize the slurry up to the point of atomization.

In this regard, plasma spraying of AlN powder requires a particular grain size distribution, such as, for example, between 50 and 100 – 150 μm for controlling the powder flow rate. That is, the AlN powder should be spray-dried in the form of hollow spheres in the related range size. Suitable spray-drying conditions include a stable suspension of AlN powder and yttrium oxide precursor in an organic solvent with some additives like binders, surfactants, stabilizers, lubricants - but not in water.

The slurry of Knudsen (AlN powder and yttrium compound in an organic solvent) cannot be spray-dried directly without additives because the suspension is not stable enough and the obtained spheres could not be handled.

I declare further that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Date: March 8, 2005

Alain PETITBON